

## DRAWINGS ATTACHED

- 1 300 163
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## (54) IMPROVEMENTS IN SYRINGES

(71) I, JULES SILVER, a citizen of the United States of America, of 166, Yantic Street, Norwich, Connecticut, United States of America, do hereby declare the invention for which I pray that a patent may be granted to me, and the method by which it is to be performed, to be particularly described in and by the following statement:—

10 The present invention relates to an improved syringe of the type having two compartments. More particularly, the invention relates to disposable hypodermic syringes where two materials are stored in separate compartments until shortly before they are desired to be used as a mixture and ejected from the syringe.

The use of two compartment hypodermic syringes is well established. In many cases it is desired to keep a powdered pharmaceutical or medicament in one compartment of a syringe but sealed off from a diluent or solvent stored in another compartment. Prior to use, the diluent or solvent is forced through some sealing means into the compartment containing the pharmaceutical or medicament. There they are mixed together and then the mixed material is forced out through a hypodermic needle, canula or opening.

Generally, the most efficient two compartment syringes have normally been made from two barrels, one within the other. Some attempts have been made to provide a two compartment syringe formed within a single barrel. However, as far as it is known, such single barrel units require intricate valve means in order to move the material from one compartment to the other.

In the present invention only a slight alteration need be done to a single barrel syringe and a simple separation added as an additional part to it in order to convert the single barrel syringe to a usable two

compartment syringe.

Accordingly, it is an object of the present invention to provide an improved, disposable two compartment syringe which is economical to manufacture, has a minimum number of parts to assemble, is easy to use and may be discarded after use if desired.

These and other objects and advantages of the present invention will be obvious from a description of the illustrated embodiment of the invention as shown in the drawings. While the drawings and the illustrated embodiment are for the purpose of enlightening those skilled in the art, the single embodiment is not to be considered as limiting the invention.

*In the Drawings*

Figure 1 is an exploded side view showing the various components of the present invention;

Figure 2 is a sectional side view of the two compartments of the present invention;

Figure 3 is similar to Figure 2 but with the plunger partially depressed to cause the separator to move to a slightly tilted position permitting material to pass from one compartment to the other;

Figure 4 is similar to Figure 2 but with the plunger contacting the separator and moved past the support;

Figure 5 is similar to Figure 2 with the plunger and the separator adjacent to each other and moved to the bottom of the barrel of the syringe; and

Figure 6 is a plan section through the barrel of Figure 2 showing the support in relation to the side wall.

Referring to the drawings and to Figure 1 in particular, a syringe in accordance with the present invention is shown as an exploded assembly of several components. The syringe is comprised of a barrel portion 12 into which is fitted a plunger 14. 90

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A compartment separator 16 is positioned transversely within the barrel 12 and rests on a support member 18. A needle 20 is attached to the barrel 12 and may be protected if desired by a needle cap 22. It is understood that a canula or any opening may be used.

As shown in Figures 2 through 5, the barrel 12 is generally of cylindrical shape comprised of a side wall 24 and a bottom wall 26. An opening 28 is provided in the bottom wall 26 and this opening communicates with the needle 20.

The separator 16 divides the barrel 12 into a lower compartment 30 and an upper compartment 32. Into the upper compartment 32, a first material in the form of a solvent or diluent (in the illustrated embodiment) is placed. A second material (in the illustrated embodiment in the form of a powder) 36 is placed in the lower compartment 30. Advantageously, the separator 16 is in liquid tight contact with the side wall 24 and therefore the materials in the upper and lower compartments 30 and 32 are kept separated from each other.

A seal plate 38 is provided on the stem 40 of the plunger 14. A thumb piece 42 is provided on the upper end of the plunger, and a finger flange 44 is provided on the barrel 12 to provide finger grips for the user.

As shown in Figure 2, the separator 16 rests on a support in the form of the abutment 18, the abutment being only a few mils thick.

The extent and size of the abutment 18 will depend upon several factors, including the diameter of the barrel, the types of materials involved and so forth. In actual practice, an abutment of at least five mils has been found to be desirable.

In order to move material from the upper compartment 32 into the lower compartment 30, the plunger is forced downwardly into the barrel in a piston-like action. The seal plate 38 is maintained in liquid tight engagement with the side wall of the barrel and forces the material in the upper compartment 32 against the separator 16. The pressure on the separator 16 is such that the abutment 18 adds support to the area 46 of the separator in contact with it acting as a cam. The remainder of the separator is not so supported and since the edge 48 of the separator 16 away from the abutment 18 is unsupported, the pressure exerted by the seal plate 38 causes that edge 48 to be forced downwardly. As it is forced downwardly it forms a passageway between the side wall and the edge permitting any material in the upper compartment 32 to pass into the lower compartment 30. The tilting of the separator is particularly shown in Figure 3.

As shown in Figure 4, after the plunger with its seal plate 38 has passed by the support 18, it becomes aligned with the separator 16 and they continue downwardly together towards the opening 28 in the bottom wall 26.

Due to the downward stroke of the plunger, all the mixed material in the lower compartment 30 is forced out of the opening 28.

When the syringe is to be disposed of after a single use, it is advantageously made from low cost plastics materials. The barrel, plunger and separator may be readily molded from material such as polyethylene or polypropylene. The only requirement is that the material used for the separator and the seal plate on the plunger be preferably and advantageously self-lubricating to permit them to move slidably through the barrel along the side wall without the need of additional lubrication.

The needle 20, if it is to be used to make an injection through the skin of a body of a human or an animal of course must be of a metallic nature such as a hollow steel needle. On the other hand though, if it is to be inserted into an opening such as the canal in the teat of a cow, it can be of a plastics material and molded integrally with the lower barrel 12. From the foregoing it is obvious that the present invention meets the objects and requirements as set forth hereinbefore.

If desired the abutment 18 may be reduced to a roughened area of added frictional restraint on the inner surface of the barrel. The separator where it contacts the area of added frictional restraint will be restrained in that area and the pressure of the material in the upper compartment will cause it to tip over in much the same manner as with the full abutment 18.

With a glass barrel the region of added restraint may be a roughened area, created mechanically, by etching or any suitable means. In such a case a separator made from a self-lubricating plastics material such as polyethylene or polypropylene will encounter a greater amount of frictional restraint at that region of the barrel than elsewhere. The roughened region may be created on one side of the separator rather than on the barrel wall. This may be accomplished by embedding an abrasive material such as fine grits of silicon carbide or other well-known abrasives in the separator in the region where increased frictional restraint is desired.

#### WHAT I CLAIM IS:—

1. A two compartment syringe including a barrel, having a longitudinally extending side wall, an end wall, an opening in the end wall, the end of the barrel opposite

to the end wall being open, a plunger having a seal plate positioned within the side wall in a slidable and liquid-tight relationship therewith, a separator positioned to divide the barrel into two compartments, the separator being in liquid-tight relationship with the barrel and means to cause the separator to be tilted from the position in which it divides the barrel into two compartments when the seal plate is forced towards the separator, so that material in the two compartments is mixed together.

2. A two compartment syringe as defined in Claim 1 wherein the separator is slidably mounted with respect to the side wall and adapted to be moved to a position between the tilting means and the opening in the bottom wall, by means of the movement of the plunger against the liquid in the barrel.

3. A two compartment syringe as defined in Claim 1 wherein the tilting means consists of an abutment on the inner surface of the barrel.

4. A two compartment syringe as defined in Claim 3 wherein the abutment extends less than halfway around the inner circumference of the barrel.

5. A two compartment syringe as defined in any one of the preceding claims wherein the tilting means consists of a region of increased frictional restraint between the edge of the separator and the inner side wall of the barrel.

6. A two compartment syringe as defined in Claim 5 wherein the region of increased frictional restraint is on the inner wall of the barrel.

7. A two compartment syringe as defined

in Claim 5 wherein the region of increased frictional restraint is on one side of the separator.

8. A two compartment syringe, comprising a barrel having a longitudinally extending side wall, an end wall, an opening in the end wall, a plunger having a seal plate and positioned within the side wall of the barrel in slidable but liquid-tight relationship therewith, a cam or support on the inner surface of the side wall, a separator positioned across the barrel and adjacent to the cam or support, said separator being in liquid-tight relationship with the side wall of the barrel and positioned between the cam or support and the seal plate on the plunger, said separator dividing said barrel into two compartments whereby two separate materials may be stored in each compartment and mixed together by forcing the seal plate towards the separator so that the material in the compartment adjacent to the seal plate forces the separator against the cam or support causing it to be forced out of liquid-tight relationship with the side wall of the barrel permitting the two separate materials to be mixed together.

9. A two compartment syringe substantially as hereinbefore described with reference to the accompanying drawings.

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FIG. 1

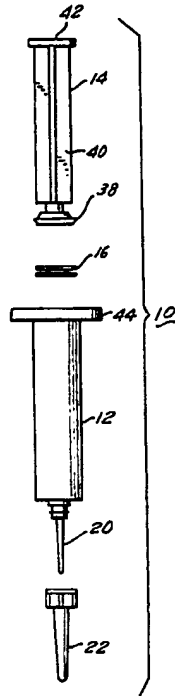


FIG. 2

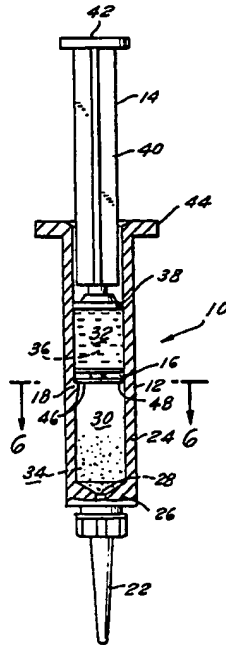


FIG. 3

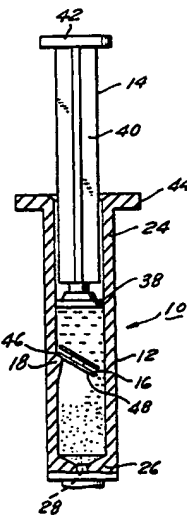


FIG. 4

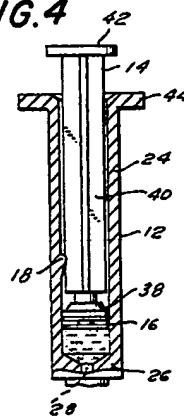


FIG. 5

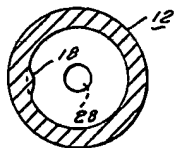
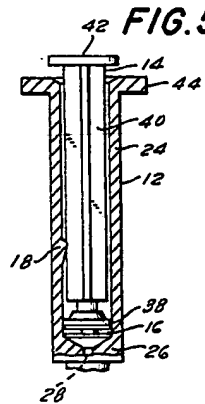


FIG. 6